The harvesting and preparation of balsam of Peru from *Myroxylon Pereiræ* are described by Preuss in *Der Tropenpflanzer* for November with process illustrations.

Further notes on the plants known as Peyote and Ololiuhqui, by Dr. Urbina, are contained in recent numbers of the *Anales del Museo nacional de México.*

The botanical origin of coca leaves is considered quite fully by Rusby in *The Druggist's Circular* for November.

Two papers on marl, of botanical interest, are published in No. 6 of the current volume of the *Journal of Geology* by Professor C. A. Davis.

Dr. Kuckuck, in Bd. IV, N.F., of the *Wissenschaftliche Meeresuntersuchungen* of the Commission for the scientific investigation of the German Sea, describes his method of cultivating algæ in the open seas.

A voluminous account of the older Mesozoic flora of the United States, by Professor Lester F. Ward, is separately published from Vol. XX of the *Annual Report of the United States Geological Survey.*

An elaboration of the fossil cycads of the Yale museum, by Professor Ward, is reprinted from the *American Journal of Science.*

A biographic sketch of Torrey, and an account of the work of the Torrey Botanical Club, appear in the October *Bulletin* of that organization.

A portrait of Ernest Roze is published in No. 7 of the current volume of the *Bulletin de la société botanique de France.*

PALEOBOTANY.

A New Book on Fossil Plants.[1] — Dr. Scott's important contributions to our knowledge of fossil plants are too well known to students of palæobotany to need any introduction. The present work is a very satisfactory summary of much of his former work, and the substance of it was first presented in the form of a series of lectures delivered at University College, London, in 1896. The lectures, however, have been entirely recast and brought up to date.

[1] Scott, D. H. *Studies in Fossil Botany.* London, Adam and Charles Black, 1900. xiii + 533 pp., 8vo, 151 figs.

The plants dealt with are, for the most part, the vascular Palæozoic plants, — Pteridophytes and Gymnosperms, — but some space is also given to the Mesozoic types.

The first chapter is partly devoted to an exposition of the aims of palæobotany and explains the different forms in which fossil plants have been preserved; the latter part of the first chapter and the two following are devoted to the Equisetales.

The earliest forms of Equisetales (Archæocalamites) occur in the upper Devonian. These oldest types were in many respects allied to the sole living genus, Equisetum. From this stock arose the much more specialized Calamites of the Carboniferous, which showed a secondary growth of the vascular bundles and more specialized fructifications. The peculiar fossils described under the name "Annularia" are supposed to be the smaller leafy twigs of Calamites. The structure of the latter is often preserved most beautifully and shows great similarity to that of Equisetum, with which the sporangia also have much in common. The discovery of heterospory in certain species is an interesting point, but it was apparently much less marked than among the Lycopods and Ferns. Dr. Scott is very positive in maintaining the strictly pteridophytic nature of all the Calamarieæ. No Calamites are found above the Permian, the Mesozoic Equisetales being for the most part closely allied to Equisetum.

Chapter IV deals with the Sphenophyllales, which Dr. Scott considers are entitled to rank as a fourth class of the Pteridophytes, having certain affinities with both the Lycopods and Equisetales. Of existing genera, Psilotum approaches Sphenophyllum in the character of the vascular bundles, but as practically nothing is known of the fossil Psilotaceæ, it is questionable how close the relationship really is.

The very remarkable fructification known as Cheirostrobus, which apparently combines calamarian and lycopodiaceous characters, is considered by Dr. Scott to belong to the Sphenophyllales and to confirm his view that "the Sphenophyllales were the highly modified representative of an ancient stock from which both Lycopods and Horsetails have diverged."

Chapters V–VII deal at length with the very abundant remains of Lycopodiales. As was the case with the Equisetales, the group culminated in the Palæozoic era, and in the later formations only the smaller and less specialized types are encountered. Heterospory, which still occurs in Selaginella, was very pronounced, and in the case of certain forms closely resembling typical Lepidostrobus,

seeds were actually developed. In spite of this, Dr. Scott is not inclined to admit that there is any connection between the arborescent Palæozoic Lycopods and the modern Conifers, although this is suggested by the similarity in habit of the two classes. He concludes that there is no satisfactory proof that the early Lycopods gave rise to any group of the higher plants — a conclusion with which all botanists will not agree.

The Ferns are the subject of two chapters, in which the different types are clearly treated. Abundant remains of Ferns, often most beautifully preserved, occur in all the formations from the Devonian onward. Unlike the other three phyla of Pteridophytes, the Ferns have held their own, and at present constitute a very important element of the vegetation of many regions, especially in the mountains of the tropics.

The fructifications are in many cases well preserved, and it is clear that the earlier Ferns were mostly types allied to the existing Marattiaceæ, which are thus shown to be a very old type, — a conclusion reached independently by the writer some years ago, from a study of the living forms. The fossil Marattiaceæ, however, showed far greater diversity than the few existing genera. The other existing group of Eusporangiatæ — the Ophioglossiæ, — which in certain respects seems to present very primitive characters, is very unsatisfactorily known in a fossil state, perhaps due to the very slight development of firm tissues in most of them.

The occurrence of leptosporangiate Ferns in the Palæozoic rocks is rare, and their affinities doubtful. A small number of types, perhaps allied to modern Gleicheniaceæ and Osmundaceæ, have been discovered, but it is not until the Mesozoic is reached that any considerable number of these are encountered. Last of all to appear are the Polypodiaceæ, preëminently the modern fern type.

Among the most interesting of the Mesozoic Ferns were the Matoninæ, now represented by the single genus Matonia of the Malayan region. This is a synthetic type, combining characters of the Cyatheaceæ and Gleicheniaceæ.

One of the most important results of recent work with the Palæozoic fossils is the discovery of a group of plants intermediate between the true Ferns and the Cycads. These Cycadofilices have been extensively studied by Scott and Seward in England, as well as by several continental workers. Among the best known genera are Lyginodendron, Heterangium, and Megaloxylon. Many of these forms which are formed from the lower Carboniferous and the Permian,

have been described as Ferns, the best known being the genera Neuropteris and Alethopteris.

The earliest of all true seed-bearing plants were undoubtedly the remarkable group, the Cordaiteæ, as to whose affinities there has been much discussion. Their remains occur abundantly from the Devonian through the Carboniferous. They present certain coniferous features, especially in the character of the secondary wood, while, on the other hand, their structure recalls the Cycads, which they resemble in the structure of the leaves. Unlike most fossil plants, the flowers and fruits have been preserved with extraordinary perfection, even to the pollen grains which are found within the pollen chamber, much as in the case of living Cycads. Most extraordinary of all, so perfectly are the pollen grains and ovules preserved, that the antheridia and archegonia are still recognizable!

Whether the Cordaiteæ really represent a type intermediate between Cycads and Conifers, may perhaps be questioned, but they certainly are one of the most interesting of all the groups of fossil plants.

The Cycads, although occurring sparingly in the later Palæozoic formations, are especially characteristic of the Mesozoic, where, as is well known, they formed one of the principal plant types. It is evident that the Mesozoic cycadean forms were much more varied than the existing genera, which show comparatively little variety of structure.

While some of the fossil forms approach closely their living representatives, both in this character of the vegetative and reproductive parts, others are extremely different, this being especially true of the Bennettiteæ. These combined typical cycadean vegetative characters with fructifications of a very different kind, and not readily comparable to that of the true Cycads. The seeds, which have been very perfectly preserved, show a large dicotyledonous embryo, nearly filling its cavity. These remarkable fossils are especially abundant in our own Potomac formation, and from Jurassic and Cretaceous formations of the Black Hills, from which Professor Lester Ward has described many new species.

Of the true Cycadaceæ, Cycas probably goes back at least to the Lias.

The Coniferæ are but briefly treated. The earliest typical Conifers seem to have been allied to the Taxodieæ, to which the fossil genus Voltzia of the Upper Permian and Triassic seems to be allied. The Permian genus Walchia, which has been supposed to be allied to the

Araucarieæ, is only known from vegetative remains, the fructification being quite unknown. Unmistakable Araucarieæ are not known anterior to the Jurassic. The Abietineæ are probably somewhat more recent, but Cupressineæ are found in the Jurassic. The Taxineæ (exclusive of the much more ancient Ginkgo) are first met with in the Cretaceous.

The extraordinary genus Ginkgo, which with the Cycads represents the oldest existing type of seed-bearing plants, and is now represented by the solitary species, *G. biloba*, is recognized by Dr. Scott as the representative of a distinct order, Gingkoaceæ, which is represented by numerous forms in the later Palæozoic and earlier Mesozoic formations. Dr. Scott agrees with Seward in assuming a somewhat near relationship between the Gingkoaceæ and the Cordaiteæ.

The concluding chapter is occupied with a summary of the general conclusions presented in the preceding chapters. We can hardly agree with the conclusion that the great antiquity of the Pteridophytes, and the absence of the remains of Bryophytes in the Palæozoic formations, is a sound argument for the entire independence of the great divisions of Archegoniates. There certainly is no evidence of any other forms from which they could possibly have sprung, while the evidence of comparative morphology is overwhelmingly in favor of a common origin for all Archegoniates. The questions of their interrelationships are by no means so evident.

The book is handsomely printed, and the illustrations are well executed and very helpful in elucidating the text. We can heartily recommend the book to all botanists interested in the fascinating study of plant pedigrees.

D. H. C.